* - *

CURRENT STATUS OF THE CEREAL LEAF BEETLE

Presentation by Donald R. Shepherd, Associate Director, Plant Pest Control Division, Agricultural Research Service, U.S. Department of Agriculture, at the Annual Extension Conference sponsored by the Crop Quality Council, Minneapolis, Minnesota, November 8-11, 1965.

Of the many insect pests that have come to this country from foreign sources, the cereal leaf beetle is one that poses a very serious threat to the vast small grain acreage of the Midwest. It is significant that about 60 percent of the insect losses in this country are attributed to introduced species. This is a loss estimated at more than $2.5 billion each year--a loss in farmer take-home pay that comes after the principal costs of production have been incurred.

Some of the foreign introductions like the codling moth, the boll weevil, the alfalfa weevil, and the oriental fruit moth have been here a long time. They came in prior to the passage of the quarantine act when there was really no effective defense against them. They spread rapidly, almost unimpeded. There have been others in more modern times--the pink bollworm of cotton, the golden nematode, the white-fringed beetle, and the Japanese beetle--that defied early attempts at eradication but, through action programs, have been prevented from spreading throughout their ecological range. In recent years others have come in like the Mediterranean fruit fly, citrus blackfly, and the khapra beetle that, with more sophisticated control procedures, have been eradicated. We are better able to cope with new introductions today but each one brings us problems that are new and different.

Scientists and regulatory officials have been concerned with the hazards associated with the introductions of new pests for a long time and have tried to do something about them. Because of the continuing threat of the many insects that we do not have here, we have catalogued some of the more important ones which could become of economic importance if they were introduced and became established. In fact, there are five volumes like this one listing those insects that could cause us trouble. Pertinent information has been recorded on more than 160 species. The cereal leaf beetle appears in the volume released in 1958. You can appreciate that early detection is vital if we are to effectively deal with new introductions as they occur. It is for that reason that we have stressed the importance of a nationwide survey and detection program the last few years.

When a dangerous new pest is found in this country we can either accept it as just another agricultural pest and learn to live with it, or we can attempt eradication. If eradication is impractical, control and

quarantine measures can be applied to delay the spread. We can live with these insects but, in our experience, that approach has been found to be very costly. We are living with the boll weevil of cotton, but the damage to the crop and control costs average about $200 million each year. Similarly, it costs about $75 million annually to live with the European corn borer. The cost is much the same for many others. The costs are great, too, for a continuing control and quarantine program to delay spread. When it can be achieved, eradication is the least costly approach. The values involved and the cost benefit relationship determine which way we should go.

If a decision is made to eradicate, time is an important factor. More often than not, regulatory officials must act before research has had time to provide all of the important basic information about the pest and the problem. We have to act immediately and then speculate on the outcome of the operation.

Experience in this country has clearly demonstrated that it is in the public interest to eradicate incipient infestations rather than to permit establishment of the pest. When effective means of eradication are lacking, destructive introduced pests are confined, if possible, within the area where they become established. Efforts are made to prevent and retard their spread and, when feasible, to reduce their numbers in the infested areas.

When the cereal leaf beetle was first found in this country in 1962, we had to proceed with a minimum of knowledge about the beetle and the problem at hand. We knew the ecological range in Europe which indicated that it would thrive anywhere in this country where susceptible host crops are grown. There are records of severe small grain losses in some of the Old World areas--losses of from 50 to 75 percent in the Ukraine, Balkans, and Caucasia. The damage in the heart of the infestation in Michigan was very severe and many fields of oats, wheat, and barley were plowed under that year. Potentially, at least, we knew that we were dealing with a serious insect problem.

From the time of the discovery of the beetle in 1962, State and Federal regulatory and research officials and the industry have gone down the line together in seeking ways to deal with this problem. Regulatory agencies considered two approaches: (1) Eradicate if the infestation was incipient and amenable to eradication; or (2) initiate a control and quarantine program to suppress populations and to delay spread. Surveys soon revealed that the infestation was extensive and with the tools and know-how at hand, eradication was not an attainable objective. A quarantine and control program was established as a holding action until more could be learned about the problem. The research agencies initiated studies immediately tc find ways to eradicate or effect control over large areas and to find ways to live with the pest. As undesirable as it is to have to live with new insect pests, we must be realistic in our approach to the problem and be ready for any eventuality.

The habits of the insect provided a clue as to what we might do about the problem. The cereal leaf beetle has four stages--egg, larva, pupa, and adult. Overwintering adults appear in the spring. They feed, mate, and the females lay eggs on the upper surfaces of the host plant leaves. Larva that hatch from the eggs begin feeding on the young, tender leaves of the host plants, oats, wheat, barley, rye, corn, and native grasses. Much of the damage is done when the plants are tillering. Summer adults that emerge after pupation feed until fall then hibernate in corn, grain stubble, under field trash, in the woods, and under other such hiding places until the following spring. There is only one generation a year in the area where the beetle occurs in this country.

Now, what have we done and where are we after three years of experience with this problem?

Survey

Surveys were initiated in the late summer of 1962 to determine the extent and intensity of the infestation. We had to know where the beetle was to decide on a course of action. Time ran out on us in the fall after infestations had been found in four counties, two each in Michigan and Indiana. In the spring, the surveys were intensified and extended. Additional infestation was found in the two States and in Ohio. Each year the area has expanded and, by the end of the 1965 survey, infestation had been found in 130 counties in four States. Illinois with three counties was added this year. Except for the counties in southwestern Michigan and adjacent areas of Indiana, populations are very low. Only seven specimens were found in Illinois in spite of very intensive surveys in the three counties.

The lack of an effective survey method is a real handicap to the program. With this pest we must resort to primitive survey methods--visual inspection and the sweep net. Both are slow and relatively ineffective. Nevertheless, we believe the total infestation pattern is fairly accurate. We are much in need of a trap and an attractant that can be used both for detection and delimiting.

Regulatory

Quarantines were invoked early by the States to prevent spread through commerce. Studies had to be made right away to determine which articles moving in commerce presented a hazard of spread. In other words, what articles had to be regulated. For a while we had to act more on theory than fact. The primary host, small grains, of course were suspect, and we found that the beetle would survive after going through a combine and through the processing at the elevator. Thus, grain going to market has had to be treated with insecticides. A treatment with malathion at the elevator costs about 1/2 cent per bushel. The beetle does not survive

more than 90 days in storage, so small grain marketed after 90 days storage is exempt. The beetle was found to survive in baled hay and straw so all hay and straw moving out of the area has had to be fumigated. The cost is about 5 cents a bale. The beetle moves into corn after small grain harvest so corn, too, is a regulated article. Ear corn is certified on the basis of inspection. Shelled corn is treated with malathion or is certified without treatment after it goes through the dryer with minimum temperature of 140°. We found that sweet corn could be certified if the growers applied the insecticide Sevin as their last treatment for corn earworm. These are a few of the problems that we have had to deal with in quarantine enforcement and the ways the problems were handled. The magnitude of the regulatory workload can be seen in a few statistics: In 1964, 34,000 tons of hay and straw were fumigated in the three States. In 1965, about 60,000 tons will be treated. There were about seven million bushels of grain treated in 1964. This year the total will probably exceed 75 million bushels.

With a new pest the quarantine has to be very tight because of our lack of knowledge about the biology and habits of the insect. As time has gone on, we have been able to make adjustments in the regulations.

We often have been asked the question, "Why haven't you promulgated a Federal quarantine?" The State quarantines are uniform so the same regulations apply in the three States. We worked with the States in developing their quarantines which now have the same regulations normally found in a Federal quarantine. We have the authority to assist the States in enforcement of their uniform quarantines and we are working with the States to effectively protect those States now free of the cereal leaf beetle.

Control

The first thing that regulatory officials think of when a new pest gains a foothold in this country is to get rid of it--eradicate. We, of course, have to fall back on treatments that have been effective with similar species or to rely again on knowledge gained with the insect in the Old World. The Michigan farmers gave us a clue as to an effective insecticide. When the infestation became heavy in their fields in 1961-62, they treated to minimize damage. The County Agricultural Agent recommended malathion emulsifiable insecticide. The growers had hydraulic ground spray equipment that had been used for other insect control so this is what they used. They got control but the large volume of mixed insecticide--18 gallons to the acre--was not practical for treatment of large acreage. The insecticide, however, was effective so we started from there. In 1963, we let a contract to treat 25,000 acres with two insecticides, emulsifiable malathion and carbaryl, but instead of 18 gallons to the acre we decided to apply only one gallon total volume to the acre. It gave good control but the cost was $3.90 per acre. That was too expensive for treatment of large acreages.

Over the years our methods improvement people have held that low volume treatments were the only sound procedure for large scale operations. We had just had experience with a low volume malathion treatment for grasshopper control so in 1964 we decided to use that treatment for cereal leaf beetle. It worked. We reduced the volume to eight ounces of technical malathion with no carrier. Against the spring emerging adults the treatment was very effective. Research studies that year showed that effective control could be achieved with only five ounces to the acre. This year in the treatment of 425,000 aggregate acres, the five ounce treatment gave an effective kill--95 percent of the emerging spring adults.

In the meantime, tests had been run with other insecticides. Of those tested, carbaryl gave the best kill of both adults and larvae. The treatment is one pound of the toxicant with water as the carrier at one gallon to the acre. We now have the two chemicals to use to control this pest. Malathion technical, five ounces to the acre, and Sevin, one pound in one gallon of water to the acre.

The 1963 treatment cost $3.90 per acre. The treatment in 1965 with malathion as the insecticide and application cost under contract was 38 cents; with carbaryl the cost is 95 cents.

This is what it costs to treat large acreages to reduce the beetle to noneconomic levels. For a farmer to obtain this control from custom operators, the cost would probably be about $1.50 per acre.

The research work associated with this problem is being done by scientists with the Entomology Research Division of the Agricultural Research Service and with the experiment stations of Indiana, Michigan, Ohio, and Wisconsin. Substantial progress has been made but there are still some blanks in our knowledge of this pest. There was some delay in the beginning until ways were found to break the diapause so that insects could be mass reared in the laboratory. This has now been done and about 5,000 adults are produced each week. This work will be expanded.

The research is proceeding along the following lines:

Further studies on the biology and ecology of the insects.

Tests are being made with additional insecticides and with different formulations of those known to be effective.

Parasites are being collected in Europe for increase and release in this country. A total of 459 specimens were released in 1964-65. The spotted lady beetle, an egg predator, is the only species that occurs in the area that has measurable effect on the numbers of the pest.

The world collection of wheat, oats, and barley are being screened for sources of resistance. Some 8,000 lines of wheat, oats, and barley have been under test.

Studies are being made with radioactive materials and chemosterilants to determine efficacy of the sterile male technique.

Chemical attractants, traps, and other techniques are under test to find an effective survey method. Of the 431 lures tested, 25 caused enough response to be useful for further tests.

Tests are continuing to improve regulatory procedures.

There obviously are quite a few things that we don't know about this beetle and still some perplexing aspects to the problem. The history of the insect in Europe would indicate that in some areas it is considered a serious pest. In others where it has occurred for a long time, it no longer rates as a major pest. It could be that in the latter areas the parasites and predators are keeping populations at noneconomic levels.

In this country we have seen evidence of its destructiveness in southeastern Michigan. Still, in Indiana with large populations, there have not been such losses. This, of course, raises questions as to its economic importance.

The principal spread has been to the east probably because of the prevailing winds. Natural spread to the west apparently will be slow.

There has been no opportunity to know what the beetle will do in an area with large contiguous acreages of small grain.

Without control there is evidence that once an infestation becomes established the insect increases rapidly and populations build up to explosive proportions. There was a tenfold increase in some areas in 1963 over 1962.

This is the story of this alien insect. We aren't entirely sure of its threat to the small grain industry. At present, the beetle is established in States that account for only 7 1/2 percent of the small grain acreage in this country. At this stage in our experience we must presume that it would be of great economic importance to the small grain production in the country. Until we know more about it we will try to hold the line and keep it confined in the area where it now occurs.

* * *

Distribution:
Code ARS-PPCP-1